



# Climate change worsens risk to public health and coping strategy in Bangladesh

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## Article History

Received: 26 September 2017

Accepted: 12 November 2017

Published: 1 December 2017

## Citation

Irteja Hasan, Tapos Kormoker, Tazmul Ahasan Azad, Ali Adnan, Shafiqul Islam. Climate change worsens risk to public health and coping strategy in Bangladesh. *Discovery*, 2017, 53(264), 636-650

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## General Note



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## ABSTRACT

Global climate change is now a reality and Bangladesh is widely recognized to be one of the most climate vulnerable countries in the world. Among the many challenges faced by the coastal communities, the effects of climate change are discernibly threatening, impacting on human settlement, agricultural production, economic development, and human health in the Chawra Union of Barguna district. The study mainly focuses on assessing current knowledge base and understanding on public health impacts due to

climate change and also to explore the different strategies/measures people employ to cope with climate sensitive diseases and sickness. A cross-sectional study was conducted among 70 households from Chawra union elected through multi-stage sampling techniques, using a semi-structured questionnaire supplemented by focus group discussions and key informant interviews. The study found that climatic changing parameter (temperature, rainfall) is increasing during 1991-2015 rapidly. A number of diseases like normal colds/coughs/fevers, dysentery, headaches, diarrhea, skin diseases, psychological disorders, malnutrition related diseases, pneumonia, measles, heatstroke, malaria, etc., is exacerbating by extreme climate events in the study area. The study also found that respondents applied different types of primary health coping strategies to prevent climate related diseases and sickness. To cope with health problems, 57.14 % used personal treatment experiences and 28.57 sought any treatments available at village level. The percentage of respondents that visited unqualified health providers to cope with climate induced health problems was quite high, Collection of such knowledge on climate related health coping strategies can allow researchers to study any specific issue on health coping, and policy makers to initiate effective climate related health coping strategies for climate vulnerable people.

**Keywords:** Climate Change, Health impact, Adaptation, Slum Dwellers, Coastal region

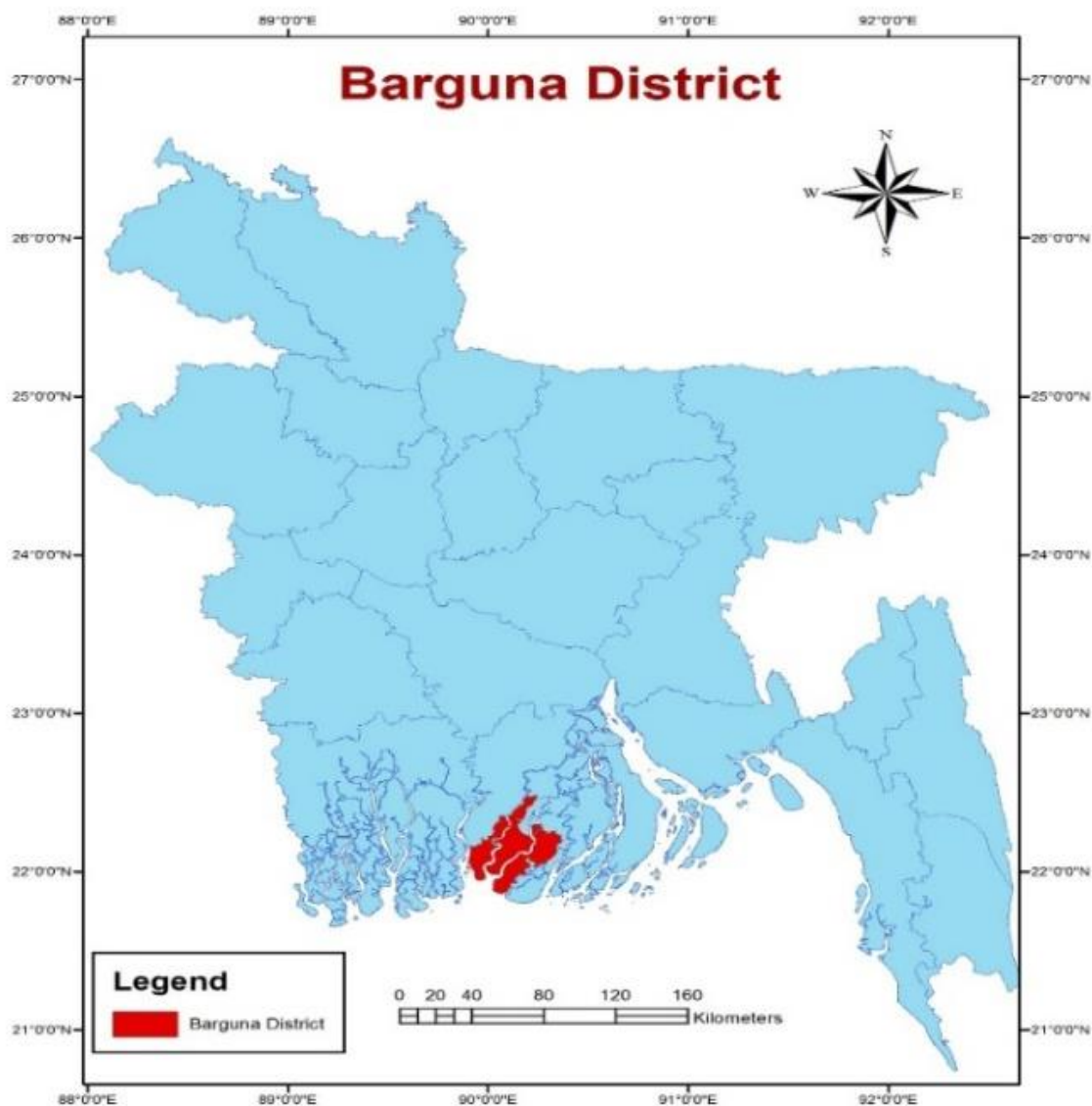
## 1. INTRODUCTION

Due to geographical location Bangladesh is a hotspot for geophysical and climatic hazards and is relatively ranked very high in terms of vulnerability to climate change. The imminent effects of climate change with potentially devastating consequences have drawn the highest attention at the global, regional, and national level during the decades (Preet et al., 2010). Negative effect of climate change on human beings is one of the greatest challenges for the international community. The world community has recognized that climate change affects human health negatively both directly and indirectly and can cause long-term effects (Hales et al., 1997; Takem Ebangha et al. 2017). It affects individuals, communities and societies as a whole (Ebi & Semenza, 2008; Hoda Rahmati & Gurudeo Anand Tularam, 2017).

Although the impact of climate change on human health will be global, the health consequences will be distributed unequally across regions, occupation, gender, and age (WHO, 2008), and vary depending on community vulnerability level (Preet et al., 2010; WHO 2009; Haque et al., 2012). People from low and middle income countries are expected to be the most vulnerable to climate change and experience the greatest impact on health (IPCC, 2001; Ebi et al., 2007; Khan et al., 2011). World Health Organization estimate projected globally an excess of 150,000 annual deaths due to changes in the world's climate relative to the climate baseline of 1961–1990 (WHO, 2011; McMichael & Butler, 2007).

In Bangladesh, where a large proportion of the population is vulnerable to climate change, health impacts are expected to take place through a variety of ways, including an increase of water and vector borne diseases and of health problems in general (Rahman, 2008; Shahid, 2009; Rahman, 2011; Forests, 2005; IPCC, 2001; Javad Amarloo et al. 2017). For example, southern part of Bangladesh is in a low-lying delta, making it vulnerable to sea level rise, severe storm-surges, floods and salinity intrusion. It is projected that a 1.5 meter rise in the sea level will inundate about 16% land of the southern part of Bangladesh, where about 17 million people live (MoHFW, 2009).

Almost every household of slum dwellers in Chawra Union under Barguna District were severely affected by the cyclone "Aila" in 2009 (MoHFW, 2009). Projected extreme climatic events, such as cyclones, floods, tidal-surges, heat waves, directly and indirectly affect major determinants of health and increase the occurrence of different diseases and sickness (German Watch 2007; MoHFW, 2009). The Climate Change Cell (CCC) of Bangladesh noted that incidences of major climate sensitive diseases (i.e. diarrhea, skin diseases, malaria, mental disorders, and dengue) have increased during last decade in Bangladesh (Climate Change Cell. 2009). A number of diseases like normal colds/coughs/fevers, dysentery, headaches, diarrhea, skin diseases, psychological disorders, malnutrition related diseases, pneumonia, measles, heatstroke, malaria, etc., can be influenced by extreme climate events in the study area (Morse and Niehaus, 2009). As an immediate response to this increased health burden, people need to seek different steps and measures to improve the health situation. Policy makers also need to know the extent of health vulnerability and the strategies people use to avert increased sickness and diseases to formulate an effective program of action in the health sector for the climate vulnerable people of the country. Very little attention has been given by the research community in Bangladesh to investigate climate related health vulnerability and the diverse responses to cope with it. Efforts to study these human health risks remain very inadequate in Chawra Union of Barguna District.



**Figure 1** Study area in Bangladesh Map

## 2. MATERIALS AND METHODS

### 2.1. Selection of the Study Area

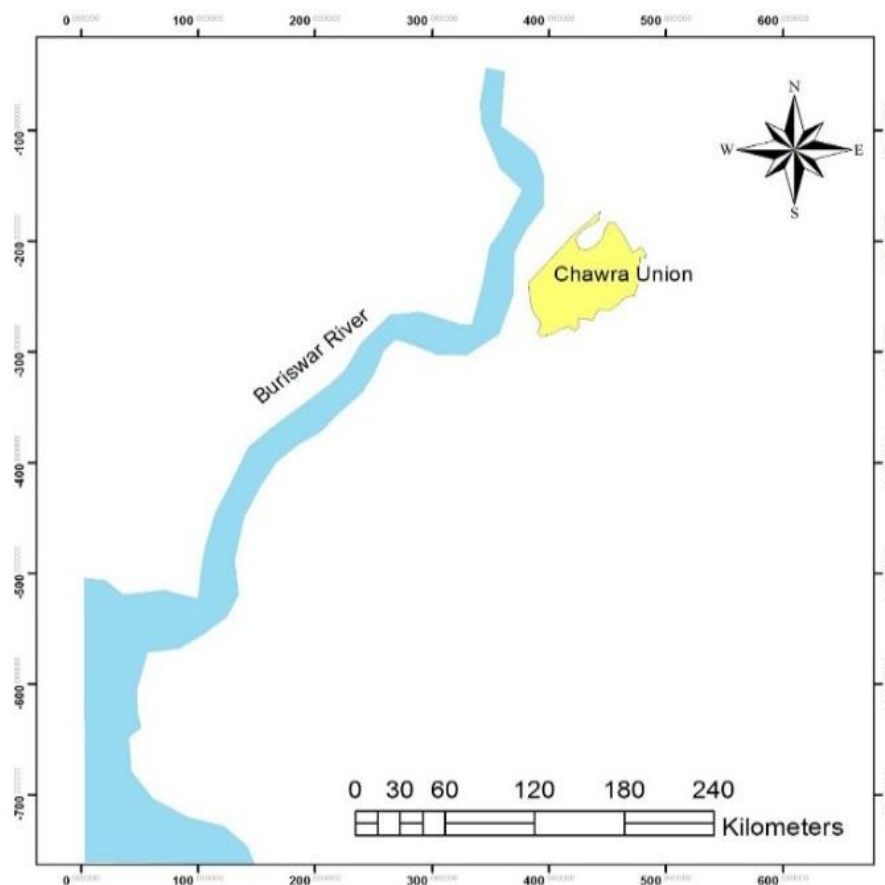
The isolation of coastal zone in Bangladesh is based on three basic natural systems of processes and events that increasing vulnerabilities in the coastal zones. The criteria are: tidal fluctuations, salinity intrusion, and cyclone and storm surge risk. It consists of 19 administrative districts of which 12 districts demonstrate all three criteria and are defined as Exposed Coast. A large number of the extreme poor people in the coastal region of Chawra union are vulnerable to the natural disaster that increases their pre-existing economic and social vulnerabilities. Climate induced natural disasters like severe cyclone, shocking tidal surges, severe floods, underhanded river erosion, excessive rainfall, overwhelming salinity intrusion, sea level rise etc. are occurring more frequently in study areas which exacerbates the vulnerability on health of slums community and socio economic conditions of the affected people.

### 2.2. Methodology

Impact on health and health coping strategies of climate vulnerable people were assessed by using a mixed method. A concurrent triangulation method was used for the study, in which qualitative and quantitative data were collected simultaneously. The findings were integrated into the results section. Populations were selected randomly to obtain a wide-range of health coping strategies for

climate-sensitive diseases among household members at community level of the country. A total number of seventy household of slum dwellers were selected for this research. Either oral or written consent was obtained from each participant. Both quantitative and qualitative instruments were used in the collection of data for the study. The validity and reliability of the instruments were insured by following a number of steps. First, a literature review was conducted to identify issues related to health coping strategies, health care providers, and sources of health care costs. Second, the survey questionnaires and interview guides for the focus group discussions (FGDs) and key informant interview (KII) were verified by experts in the field of health economics, public health and climate change. Third, the tools were pre-tested among 11 males and 9 females in the field and modified as needed before producing the final version. Qualitative data were collected through FGDs and KIIs. All FGDs and KIIs were transcribed and analyzed according to the broad themes: impact of health due to climate change, health coping strategies, choice of treatments/care, choice of providers and sources of the costs for health care etc.

## Chawra Union Map, Amtali Upazila, Barguna

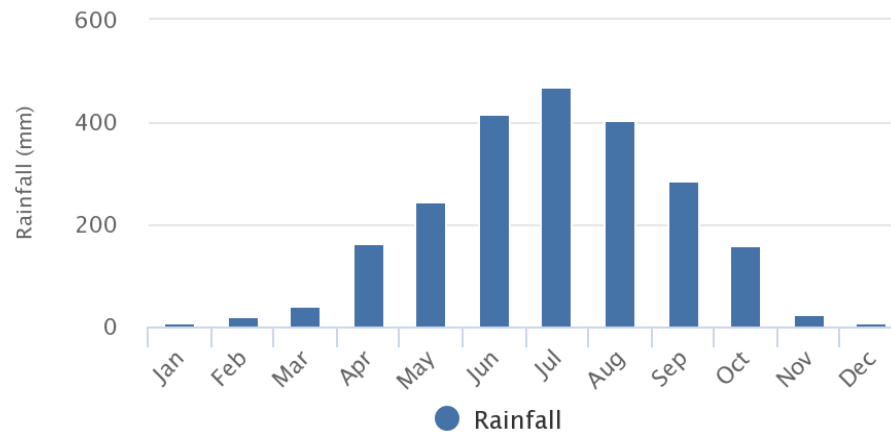


**Figure 2** Chawra Union Map

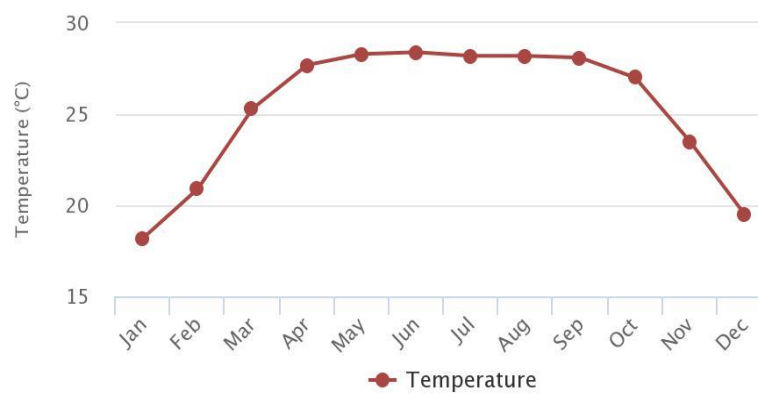
### 3. RESULTS AND DISCUSSION

#### 3.1. Climate Characteristics (Temperature, Rainfall)

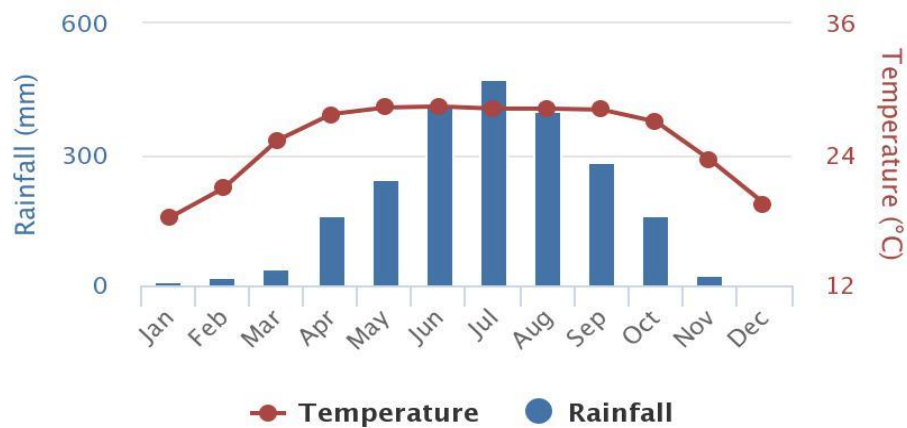
Climate data is important because it has varied and changed in the past. The climatic data comprised monthly mean temperature and rainfall for the period of 1991-2015. The data were analyzed to find intra-seasonal, seasonal, annual and decadal changes. The total amount of average rainfall and temperature is changing rapidly in the last fifteen years (Figure 3 & 4). The monthly mean historical rainfall and temperature data can be mapped to show the baseline climate and seasonality by month, for specific years, and for rainfall and temperature. The chart above shows mean historical monthly temperature and rainfall for Bangladesh during the time period 1991-2015.



**Figure 3** Average Monthly Rainfall for Bangladesh from 1991-2015



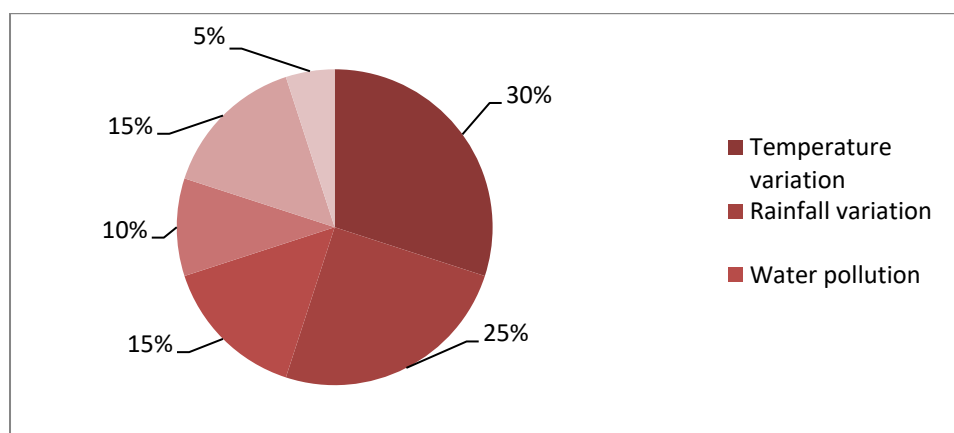
**Figure 4** Average Monthly Temperature for Bangladesh from 1991-2015



**Figure 5** Average Monthly Temperature and Rainfall for Bangladesh from 1991-2015

### 3.2. Household's Opinion on Possible Reasons for Disease

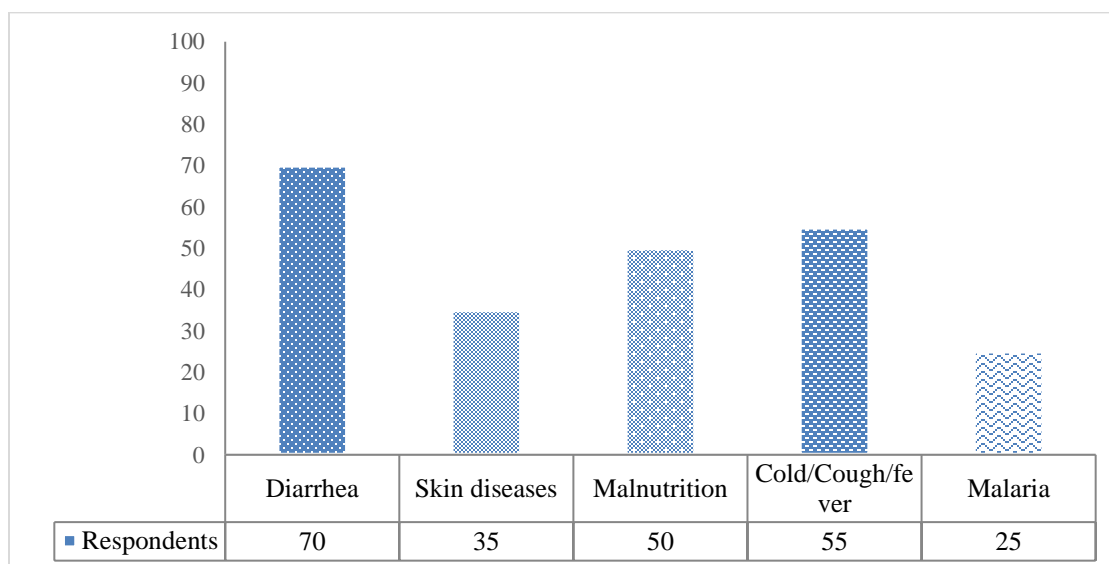
The household respondents of Chawra union were asked about their opinion on the possible reasons for occurring different kinds of diseases. It was found that most of the respondents of slum dwellers indicates temperature variation, unplanned sanitation system, during hazard/disaster, rainfall variation are the possible reasons for diseases. The Figure 6 shows that 30 % respondents pointed out to change in temperature causes diarrhea incidences. It also shows that 25% and 15 % of them mentioned that rainfall variation is the possible cause of diarrhea. Many of the respondents mentioned the reasons of other diseases like skin diseases and common cold/fever/cough due to water pollution (15%), unplanned sanitation (10%).



**Figure 6** Household's opinion on possible reasons for disease due to climate change

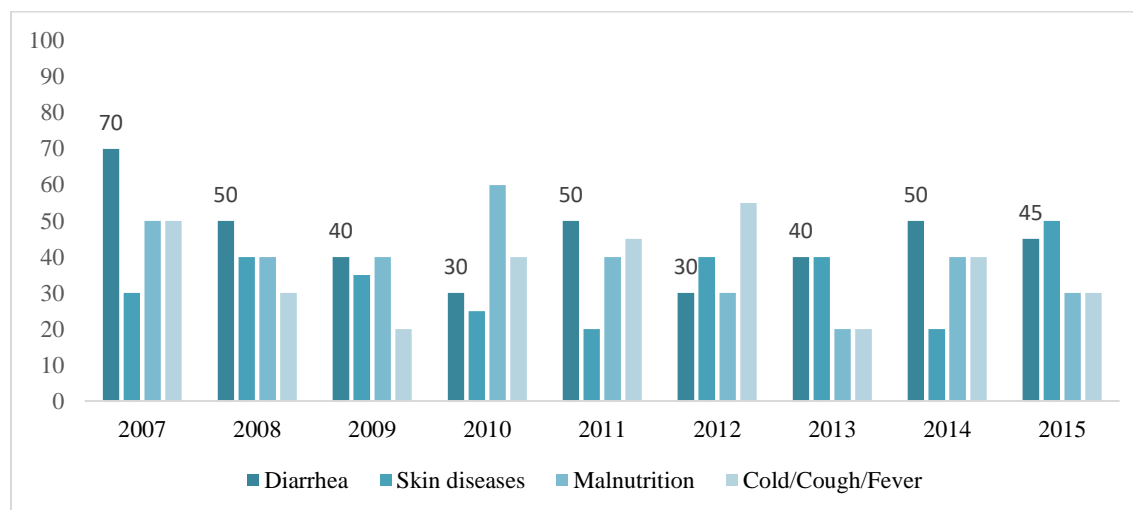
### 3.3. Disease Profile

Although the Household respondents identified various diseases, the analysis was mainly on climate sensitive diseases. According to response of the households, diarrhea were identified as common diseases by 70 % respondents of coastal slum communities while skin diseases usually affect them only 35 %. Again of 50 % of respondents were for malnutrition. On the other hand, most of the participants from all slum households identified cold/cough/fever (55%) as common disease.



**Figure 7** Disease profile in the coastal belt of Bangladesh

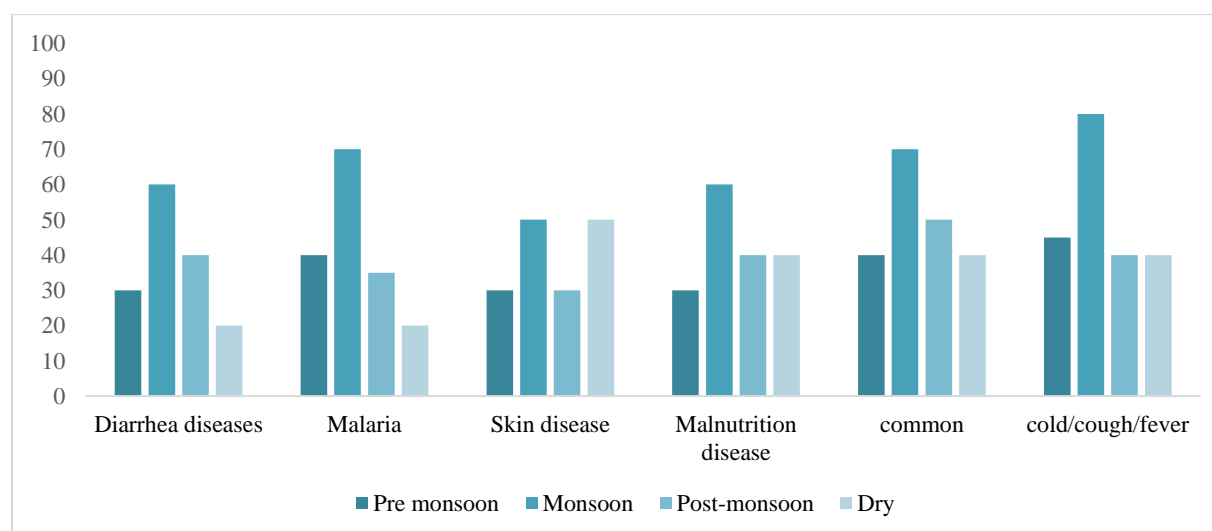
It was observed that the Diarrhea occurrences ranged between and from 2007 to 2015. The highest occurrences were found in 2007 after the cyclone SIDR while the lowest was in 2010. Skin diseases were found to have an increasing trend from 2010 to 2015 while occurrences of malnutrition show irregular pattern. The following figure shows an increasing pattern of Diarrhea, Skin diseases, Malnutrition and Cold/cough/fever.



**Figure 8** Trend of climate sensitive diseases

### 3.4. Seasonal Health Disorders

Seasonal occurrences of all four types of diseases in each year over the period 2007-2015 were also observed. Occurrences of diarrhea remained highest during monsoon in most of the year. Skin diseases incidences were observed with little variation for all the seasons of the year. Malnutrition was found to have highest occurrences during post-monsoon in early years of the last decade while it was highest in monsoon during 2nd half of the last decade except in 2002. However, the highest malnutrition disorders were observed during monsoon and the lowest was during dry (Figure 9). On the other hand, cold/cough/fever diseases follow an increasing trend in almost every season in each year from 2007 to 2015.

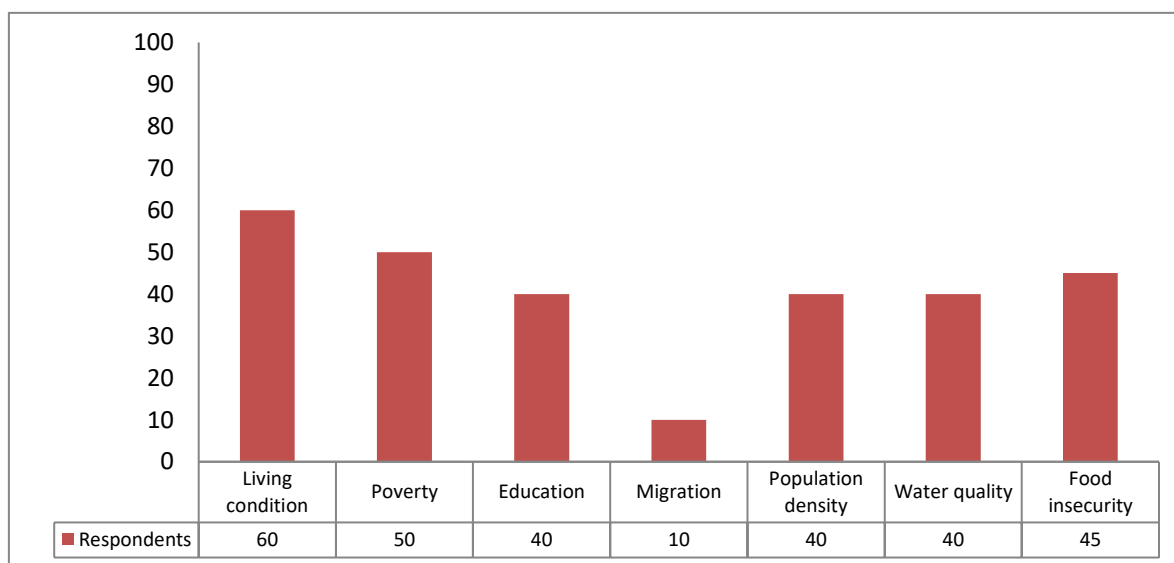


**Figure 9** Seasonal health disorders in the study area

### 3.5. Social Factors

During FGD and in-depth interviews, most of the participants mentioned that there is change in seasonal weather, rainfall, humidity etc. Many of the participants specifically said that the living condition, poverty, education and migration are the cause of health problem in the study area. Household environmental conditions were identified as an important determinant of the incidence of childhood diseases, although the interactive effect of extreme precipitation with drinking water sources or sanitation facilities is not statistically significant. The estimation results show that unsanitary toilet facilities are a key factor determining the incidence of fever and ARI, but only in urban areas. Poor sanitation facilities are identified as a key determinant of disease incidence in urban but not in rural areas. During the pre-monsoon season in urban areas, a child living in a household with unsanitary toilet facilities (slab, pit, or open latrine) is two times as likely as a child living in a household with access to a flush toilet (septic sink) to experience an episode

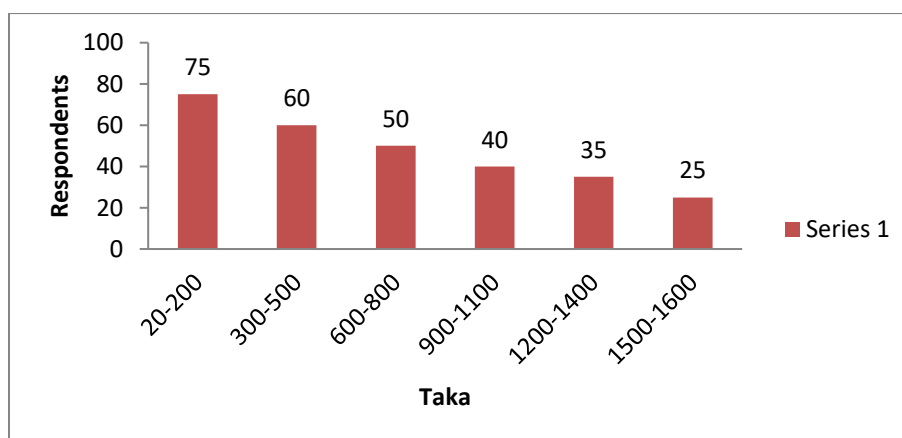
of ARI and nearly three times as likely if living in a household with no toilet, holding all other factors constant. During the monsoon season, unsanitary toilet facilities significantly increase the incidence of fever. Given that fever is a symptom of many infectious diseases, this finding suggests that households with poor sanitary facilities are likely to be located in areas with unsanitary living environments, which are conducive to the development and spread of a wide range of pathogens and disease vectors (Harshal Tukaram Pandve, 2017). Contrary to findings in other studies, no statistically significant effect of drinking water sources on disease incidence is established in these two national surveys. The estimated impact of water quality (40%) causes different kinds of diseases, such as fever and ARI etc.



**Figure 10** Social factors impact on health

### 3.6. Medical Expenditure

As slums people live in the coastal areas, they experience different kinds of climatic variables. Temperature changes, extreme precipitation, destructive disasters affect their health conditions. Most of the people in slums are poor and they had to expend on treatment sometimes even if they went to the govt. hospital. In the Upazilla Health Complex, the treatment is almost free and all the respondents who went there comment positively about their service. Seventy five (75%) percent respondents mentioned that they spent from Tk. 20 to Tk. 2000. The average expenditure for diarrhea treatment is 200 or 300 taka. On the contrary, those who suffered from other kinds of disease, they also expended 1500-1600 taka on average. The increasing disease due to climate change impact on their livelihood and also increased their food insecurity.



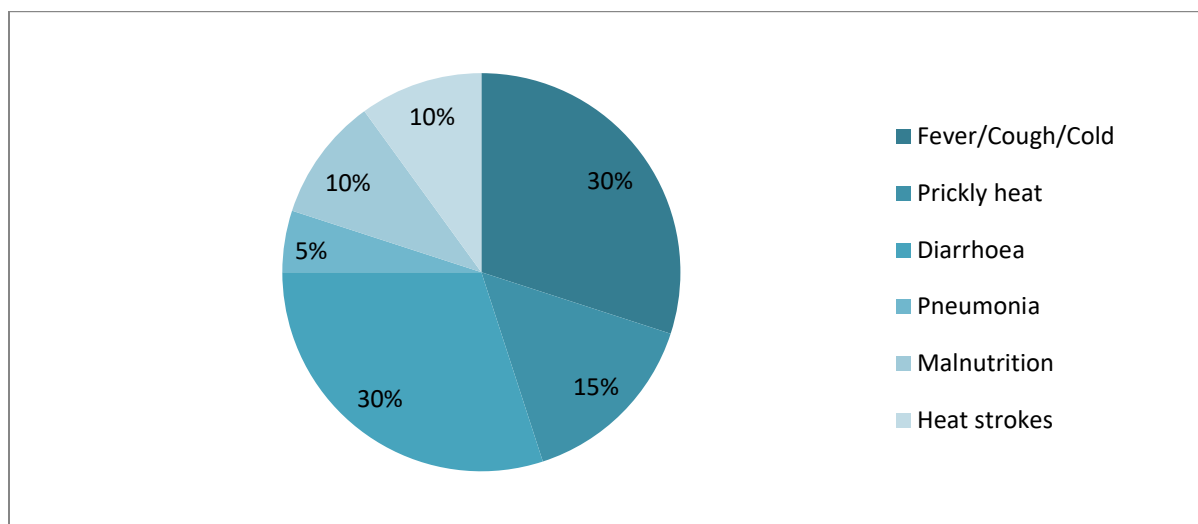
**Figure 11** Average medical expenditure in the study area



### 3.7. Direct Impact

#### 3.7.1. Incidences of Diseases: Temperature variation and Heavy Rainfall

Warmer average temperatures will lead to hotter days and more frequent and longer heat waves. Most of the respondents of slum dwellers in Chawra Union belief that temperature and rainfall is increasing. As a result due to increase of temperature during summer season, different kinds of diseases hamper their normal life. The results found that Rickshaw pullers and the farmers are working in open field and both are most vulnerable to heat stroke (10%) due to the rise of temperature. Children and elderly people are at particular risk to the Prickly heat (15%) caused by elevated temperatures.

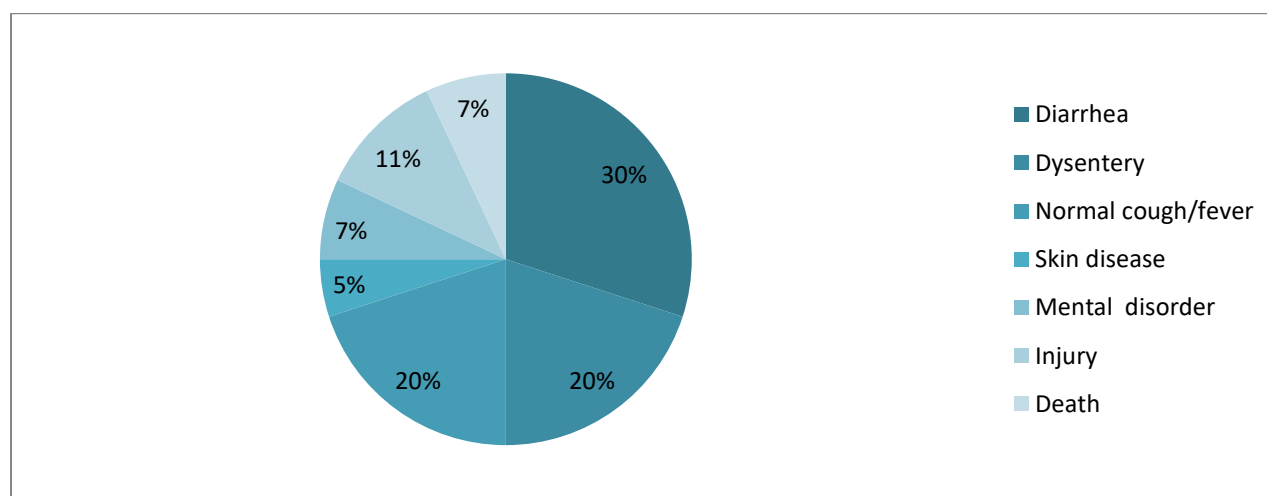


**Figure 12** Incidences of diseases due to temperature variation and heavy rainfall

The excessive rainfall causes common fever/cough/cough (30%) which is increasing the slums dwellers medical expenditures. During excessive rainfall, day labors are became unemployment and their family started starvation. As a result malnutrition (10%) is increased among the coastal slums communities.

#### 3.7.2. Incidences of Diseases: Cyclone

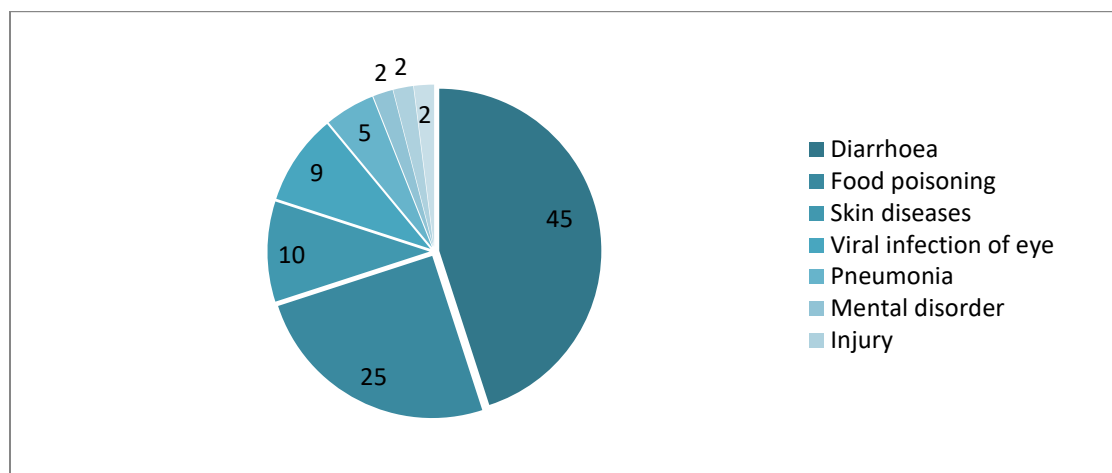
In response to a question on incidences of diseases during hazard/disaster like Cyclone the respondents of Chawra Union Slums mentioned that occurrences of diarrhea, dysentery and normal fever are higher than the other diseases. In fact, 30% household respondents mentioned diarrhea as common diseases during Cyclone while 20% were for both dysentery and normal fever/cough. Besides, 7% and 5% of respondents pointed out mental disorder and skin diseases that occur during destructive cyclone.



**Figure 13** Incidences of diseases due to cyclone

### 3.7.3. Incidences of Diseases: Flood

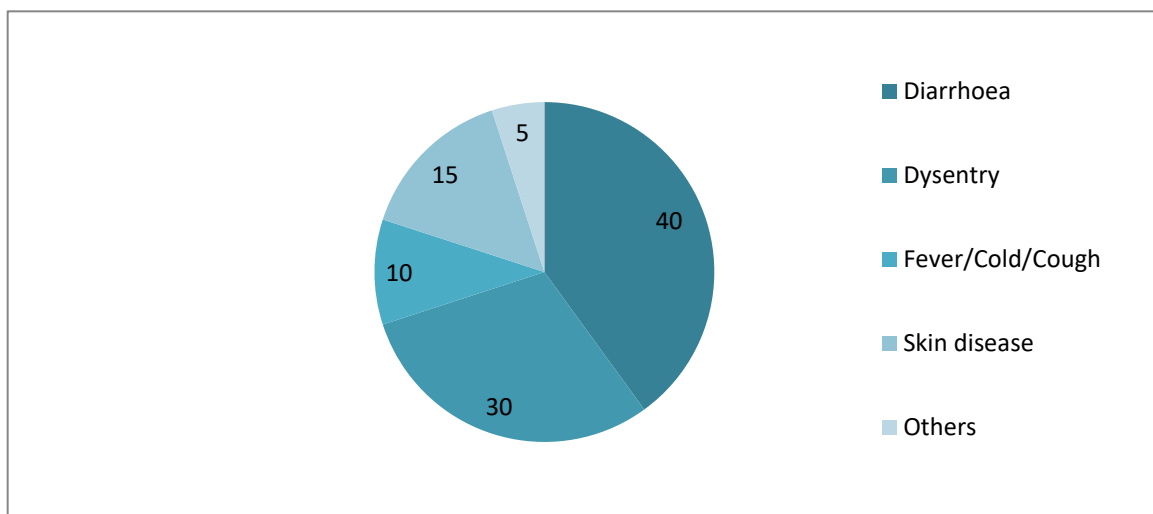
The slums people of Chawra Union were asked about the health problems, most of the respondents in every household mentioned about diarrhea, dysentery, common cold/fever etc. are the main culprit during hazard period of floods. The slums respondents mentioned that diarrhea (45%) affect more than other diseases during flood period. On the other hand, 25% respondents said that they suffer from food poisoning during hazard while 10% of the respondents said they suffer from skin disease due to water contamination.



**Figure 14** Incidences of diseases due to flood

### 3.7.4. Incidences of Diseases: Salinity Intrusion

The respondents of the study area gave detail information on the incidences of diseases during different types of hazards/disasters. At least forty 40% and 30% respondents mentioned salinity intrusion causes diarrhea and Dysentery in the study area. Again 15% believed that it causes skin diseases as well.



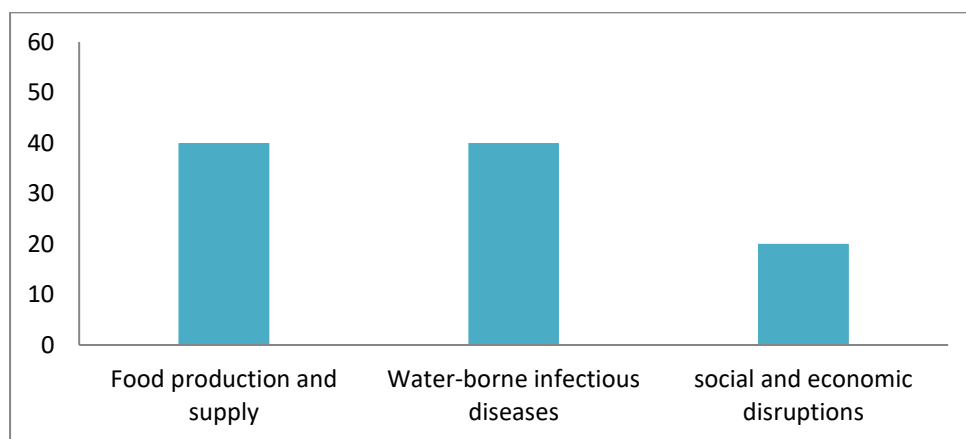
**Figure 15** Incidences of diseases due to salinity intrusion

### 3.8. Indirect Impact

Climate change will have mixed effects on food production which exacerbating health risk in the coastal belt of Bangladesh. It was found that different types of climatic risk are destroying the food production (40%) and as a result the market price of food is increased. As a result, slum dwellers community cannot afford such kind of increasing food cost. They start to starve and it is increasing their health risk. They also do not have access to safe drinking water and sanitation. Climate can increase directly the amount of pathogen in the water through increasing the biotic reservoir of the infectious agent (cholera) or by decreasing the

amount of water in a river or a pond and thus raising concentration of the bacteria (typhoid). Floods can cause contamination of public water supplies with both bacteria and parasites as surface discharge flows into rivers and reservoirs, while drought can increase the concentration of pathogens in the limited water supplies. Global warming is expected to lead to changes in the river and ponds water that alter risks of bio-toxin poisoning from human consumption of fish. For example, higher sea surface temperatures also would increase the occurrence of algal blooms that may affect human health directly, and which are also ecologically and economically.

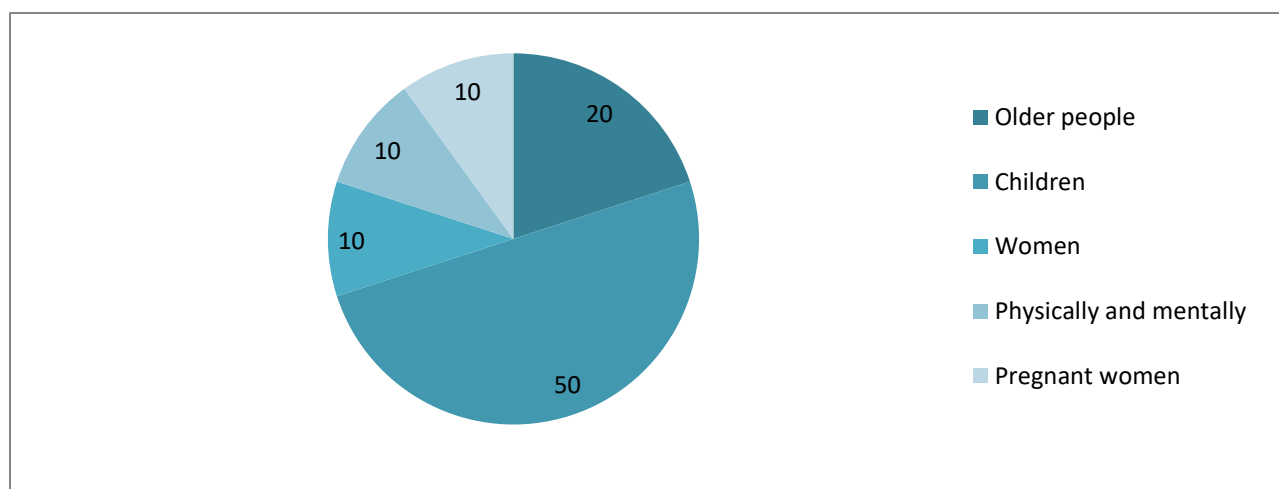
In some settings, the impacts of climate change may cause severe social disruptions (20%), local economic decline and population displacement that would affect human health. The particular concern is the impact of different kinds of climatic problems, population displacement are increasing, natural disasters or environmental degradation is likely to lead to substantial health problems, both physical and mental damaging.



**Figure 16** Indirect impact on health due to climate change in the study area

### 3.9. Vulnerable Population

According to the respondents of the study area, it is found that some particular people such as older people, children, women, pregnant women are more vulnerable and during the previous Cyclone SIDR & Aila, these types of people were affected moderately.



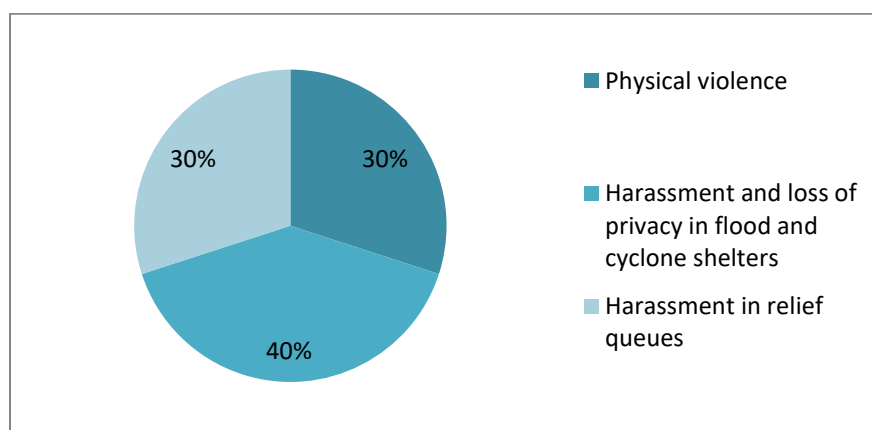
**Figure 17** Vulnerable population health due to climate change

Children health (50%) is the most vulnerable due to climate change and they seriously affected diarrhea, dysentery and other kinds of diseases. Due to poverty condition, pregnant women did not get proper food as they required supporting his health. As a result, pregnant women (10%) are suffering malnutrition and women (10%) are same respectively. The severe effect of any climatic problems, they suffers physically and mentally (10%). The older people are also undergoes by any kinds of climatic events.

### 3.10. Impact on Women's Physical Security and Dignity

Women in Bangladesh still experience various types of violence, and physical, sexual and emotional violence increases during and after a climate induced disaster in the study area. As psychological stress increases during disasters, and more men are left without employment, male relatives of many women have been reported to vent this increasing frustration via abusive language or exertion of physical force (40%). Reasons given for this abuse range from women not being able to manage resources properly, to not serving food on time, to not being able to procure relief materials. Many women (40%) refrain from going to shelters during a disaster or when a warning signal is issued in fear that they would have to share a room with strange men. Pregnant women and nursing mothers tend to be reluctant to share space with or nurse in front of strangers. Some women with disabilities also mention facing some form of violence in shelters, including mental abuse and physical torture.

Thirty percent women (30%) often face additional physical insecurity and loss of dignity while collecting relief during or after a disaster. In many cases, they have to walk long distances through water, their wet clothes clinging to their bodies, to collect relief. During collection they have to stand in long queues with male strangers. Sexual harassment is often reported.

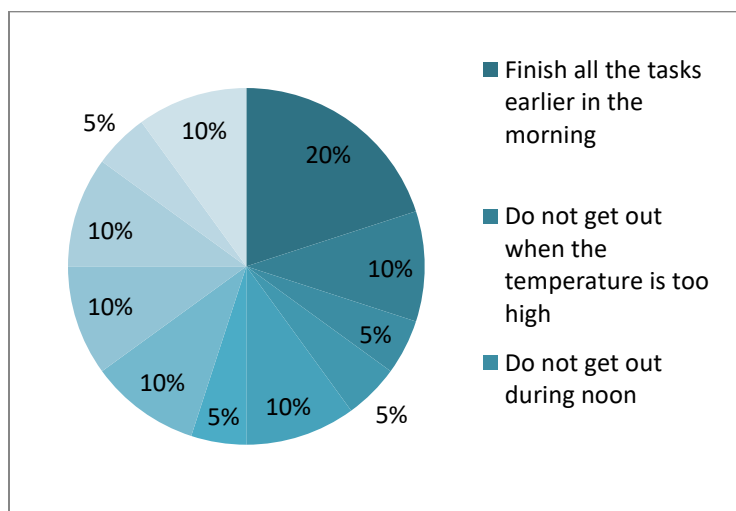


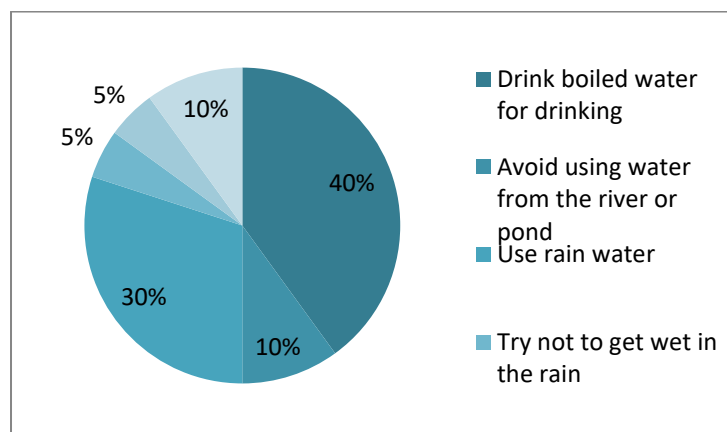
**Figure 18** Impact on women's physical security and dignity

### 3.11. Adaptation Strategies

#### 3.11.1. Existing Coping Strategies to Deal with Health Impacts Due To Climate Change Events

The respondents reported 17 types of different primary strategies to prevent themselves and their family members from the effect of climate change on their health (Figure 20 and 21). Seven of these health coping strategies dealt with heat, cold and precipitation, 6 with climate induced natural disasters and five from indigenous strategies. In addition, the respondents approached neighbors, relatives, people who suffered from similar sickness and NGO workers to discuss the climate-related health problems respondents faced and possible methods for preventing diseases/sickness.





**Figure 19** Health coping strategies of the respondents for preventing sickness and diseases from extreme heat, cold and precipitation

### 3.11.2. Curative Health Coping Strategies Options and Choices

At the onset of disease and sickness 57.14 % of the respondents used their self-knowledge of medication and previous healing experiences to treat themselves and their family members; 28.57 % sought treatment available in the rural area (Table 1). In response to the question "what were the choices among the health coping strategies in case of climate sensitive diseases or sickness for your family members," 50 % of the participants reported that self-knowledge or home-remedies and previous healing experiences were the first strategies they used in treating climate related health problems. Approximately 28.57 % of the respondents sought any treatment (which included qualified, unqualified providers) as their first choice. Respondents used multiple means to cope with climate sensitive health problems.

**Table 1** Health coping strategies by the survey participants (n=70)

Health Coping Strategies	1st choice		2nd choice		3rd choice	
	1 <sup>st</sup> choice		2 <sup>nd</sup> choice		3 <sup>rd</sup> choice	
	Yes		Yes		Yes	
	n	%	n	%	n	%
Applied personal experiences & knowledge	40	57.14	35	50.00	0	0.0
Sought treatment (qualified/unqualified treatment)	20	28.57	20	28.57	3	4.28
Wanted to but could not afford	5	7.14	10	14.28	3	4.28
Did nothing	5	7.14	5	7.14	23	32.85
Total	70	100.0				
*n=number						

### 3.11.3. Health Care Providers Options for Health Coping

There were 12 types of health providers available in the study areas (Table 2). Most of them were unqualified health care providers. They included village doctors, drug stores, folk medicine, family welfare assistants/visitors, homeopath and spiritual healers. The percentage of visiting the village doctors was 28.57, drug stores and self-medication was 14.28. Unqualified providers were people from within the villages, known to them, they were open for whole day (morning, afternoon, evening), and people could negotiate their payment and buy medicine in credit. The use of qualified providers (health services at Upazila Health Complex and UFHWC) was low compared to unqualified providers. Only 7.14 % respondents of slum dwellers reported that they had visited the Upazila Health Complex (UHC) for treatments. The UHC is the second level of the health structure of government. It has specialized health services for inpatients with outpatient/outdoor services. A KII informed that "its waste of time visiting Union or Upazila health

facilities as there is no medicine supply, no doctor, and no treatment when we visit. We are not sure that we will get treatment what we need”.

**Table 2** Types of health care providers visited (n=70)

Health Care Providers					
Unqualified providers (UQP)	Yes		Qualified Providers (QP)	Yes	
	n*	%		n*	%
Village doctor	20	28.57	<b>Public</b>		
Drug stores	10	14.28	Upazila Health Complex	5	7.14
Self-medication	10	14.28	Union Health/Satellite Clinic	6	8.57
FWA/FWV/Nurses	5	7.14	<b>Private</b>		
Medical assistant	6	8.57	Private clinic	4	5.71
Homeopath	7	10.00	Paramedics	5	7.14
Spiritual treatment	9	12.58			
Folk medicine	3	4.28			
*n=number	70	100			

#### 4. CONCLUSION

People of the slum dwellers communities included in this study are concerned about climate induced diseases and sickness and sought preventive as well as curative measures to cope with health problems. Every respondent used traditional knowledge and known health care practices to cope with climate sensitive health problems. Seeking health care from unqualified private health care providers is the most commonly used most available health coping strategy in treating sicknesses and illnesses brought on by climate change. Public health care facilities at the community level are not used by the respondents to cope with the same health problems. Per family spending to cope with such health problems is very high and health care is solely based on out of pocket payment. Most of them had to depend on their available family assets as well as their “social capital” to cope with climate related health problems. There is no fund pooling, community funding or health insurance program in the study areas to support the overall health coping of the climate vulnerable people. Initiatives and strong advocacies are needed from the government, NGOs and development partners to improve the health coping options for the people vulnerable to climate change in the rural areas. They also need to set measures, to reduce OOP payments and high health care costs and to improve the health services at public and private levels. Such measures are necessary for helping the people vulnerable to climate change in resource poor settings to cope with additional climate induced health problems. Coping with climate related health problems at the village level is mostly an individual's responsibility that is dependent on unqualified treatments at high prices. There is neither community based mechanism to cope with climate induced health problems nor any additional program or support from the government. The collection of such information on climate related health coping can benefit the government, NGOs and development partners in formulating strategies for effectively coping with the climate induced diseases and sickness.

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